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AUTHOR Buckenmeyer, Janet

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ABSTRACT

The appropriate use of technology in education is one viable solution to the challenge of training students for the Information Age. Benefits and barriers are presented in this paper. Benefits include improved student performance and behavior, and an efficient manner of procuring information. An additional benefit is the global awareness and education that technology provides for learners. There are many factors responsible for the non-adoption of educational technology among teachers, including lack of computers in the classroom; lack of release time for teachers to learn how to use computers and the Internet; and lack of time in the schedule for students to use computers in class. In spite of the potential limitations, educational technology can work effectively with school systems to properly equip students for the future. Experts in the use of instructional technology have suggested that there are four factors necessary to facilitate the adoption of technology. First, the process of change needs to be situated to each particular school. Second, establishing a goal is critical. Third, is the necessity of staff development. Finally, technical support must be provided. (Contains 26 references.) (AEF)

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Educational Technology:
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By: Janet Buckenmeyer

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Lessons Learned from a University Partnership Established to Promote the Adoption of Educational Technology: One Size Does Not Fit All

Janet Buckenmeyer
The University of Toledo

Introduction

The accessibility and affordability of the computer and the rapid expansion of the Internet, has put information literally at our fingertips. We are now able to procure volumes of data with just the stroke of a key. The field of technology is rapidly accelerating to allow for commonplace interactive audio, video and computer conferencing. Possibilities for communicating and exchanging information seem limited only by our imaginations.

Therefore, in order to prepare students for this swiftly changing Age of Information, the use of technology in education should become a critical factor. It is no longer enough that instruction flows from teacher to student, nor will it be enough to only expose students to technology; students must learn to become active participants in the process of their education. We need to recognize that social, political and economic changes are occurring and forcing our society to offer alternatives to traditional education. Research over the past 25 years has shown that interaction involving a purposeful cognitive approach by the student is an essential component in the learning process. Therefore, education courses need to encourage students to be self-reflective, self-corrective and self-constructive learners. Specifically, technology in education, with its "instant" availability, but more importantly, with its ability to allow learner control, is a viable solution to this need.

Background Information

The nature of the Information/Communication Age in which we live demands that we prepare the students of today for the challenges of tomorrow. Change is occurring faster everyday and students and society are left economically and socially at risk (Lane & Cassidy, 1997). As a result, students will need to not only be prepared, but empowered. In order to increase global awareness, keep pace with and implement the rapidly changing technology, and adapt to the changes in the work force, schools need to adjust to meet these demands.

Traditionally, the teacher has been at the heart of the educational system as the deliverer of knowledge and the center of learning. However, with the onslaught of available information, teachers are no longer able to know everything of value to teach students, but are now learners along with their students. No longer isolated work units within a classroom, the teacher of today needs to facilitate the learning of the students and empower them to explore and learn by accessing the additional expert resources in the community and throughout the world (Guerra & Alvarez-Buylla, 1995). Methods and strategies involved in facilitating this process need to include guided practice, inquiry learning, and teamwork. Interaction must be a part of the learning process; however, the teacher may or may not be physically present.

Since educational technology, when properly used, forces the role of the teacher to shift, it is a natural conclusion that the role of the student must also change. For example, research shows that learners presently enrolled in distance education courses are more likely to be active listeners and are able to work independently (Trier, 1996). While motivation is a key factor, it can be increased if students feel that there is a certain relevance to the medium and the message and if they are given the opportunity to create a meaningful project from the material covered. Students will be given more initiative and have more control over what they learn. Behaviors expected of students will include being self-directed, responsible, and proactive.

In their research, Roblyer, Edwards and Havriluk (1997) note that students realize several unforeseen benefits. Slower students blossomed, less popular students were sought out for advice and assistance, and formerly unmotivated students became excited and involved. Teachers of these students observed improvements in student academic performance, self-esteem, and increased acceptance of responsibility (Roblyer, Edwards & Havriluk, 1997).

However, when any classroom is transformed because of the appropriate use of technology, it is to be expected that students need an adjustment period. Changes in the approaches to teaching and to learning will result in cognitive dissonance. Students will no longer be able to expect traditional behaviors from teachers, while simultaneously, they are readjusting to their new responsibilities.

Further, the role of the school will have to shift in order to more accurately reflect the work environment. Work environments, and the world in general, are increasingly becoming global in their operations. Contemporary society is faced not only with the problem of promoting the expansion of knowledge, but also of generating a workforce which is capable of adjusting to the Information Age. Students will need to learn more effectively and efficiently than ever before because of the rapid growth of information and because of the escalation of knowledge and skill requirements for most jobs (Wellburn, 1996).

The Contributions of Technology to Education

Before technology will be adopted into the educational process, teachers must first be convinced that there is some advantage to using technology. Findings from the Apple Classrooms of Tomorrow (ACOT) research suggest that students' behaviors and attendance improved, along with attitude toward themselves and toward learning (Ringstaff, Yocam, & Marsh, 1996). Improved student performance was also noted in several ways: (1) test scores indicated that, despite time spent learning to use technology, students were performing well, and some were clearly performing better, (2) the students wrote more, more effectively, and with greater fluidity, and (3) some classes finished whole units of study far more quickly than in past years (Ringstaff, et al, 1996). Other unintended outcomes were noted which included students becoming socially more aware and more confident, students working well collaboratively, and students exploring and representing information dynamically and in many forms (Ringstaff, et al, 1996).

Educational technology makes it possible to create learning situations in which students can be engaged in activities that they find interesting and exciting for their own reasons and which accomplish the educational goals of teachers (Riel, 1989). Teachers can plan various activities simultaneously, and students can learn in an interactive, workshop-style format (Piper, 2000). Computers give teachers the opportunity to expand the boundaries of the classroom (Facemyer & Peterson, 1996, as cited in Piper, 2000) by allowing instant access to information and specialized expertise. In addition, educational technology can create new avenues for social exchange and cooperative learning (Riel, 1989).

Barriers to Change

There are many factors responsible for the non-adoption of educational technology among teachers. The National Center for Education Statistics (NCES, 2000) reports that in 1999, one of the barriers most frequently reported by public school teachers was the lack of computers. If teachers are expected to use computers in the classroom, it is only logical to assume that computers will be provided. However, access alone doesn't ensure adoption of technology. Location, access, and current, compatible software play a part in determining how they will be used (Sheingold, 1991). Moreover, teachers at schools with minority students accounting for more than 50 per cent of enrollment were more likely to cite outdated, unreliable, or incompatible computers as barriers to use (NCES, 2000).

Even if the problem of access is solved, teachers must still be taught to help their students effectively use Internet resources for learning purposes. Evaluating web-based resources is an essential skill because the Internet, besides hosting a wealth of valuable educational resources, is also the single largest source of misinformation in our society (Maney, 1999).

Another barrier reported frequently by public school teachers was the lack of release time for teachers to learn how to use computers or the Internet (NCES, 2000). Franklin (1999) reports that time was the most often recorded item on the list of barriers that remain in place to prevent technology adoption. She further states that "this coincides with the President's Committee of Advisors on Science and Technology, which found teachers did not have enough time in the day to develop new lesson plans for the implementation of technology when technology was newly placed in a school" (Franklin, 1999). Chiero's (1997) study on *Teachers' Perceptions On Factors Affecting Computer Use* lists lack of time as the single most important barrier to technology adoption. Teachers must be allowed adequate time to learn new technologies (Maney, 1999). A lack of time constrains teachers from thinking about new ways of organizing learning in their classrooms by the need to handle day-to-day issues, surprises, crises and challenges (Fullan, 1999). Among other things, this daily press for time makes teachers dependent upon what they already know and prone to following routines (McKenzie, 1999).

An additional barrier reported by teachers is lack of time in the schedule for students to use computers in class (NCES, 2000). Traditional 40 or 50-minute class periods do not allow sufficient time for students to be engaged in learning through use of technology.

If teachers are going to adopt and use technology, there must be a support infrastructure available to help them troubleshoot and solve technology-related problems (Maney, 1999). This includes administrative support, technical support or advice, and support regarding ways to integrate telecommunications into the curriculum (NCES, 2000).

Other barriers to technology use as reported by the National Center on Education and Statistics (2000) from teachers' survey responses included concern about student access to inappropriate materials and inadequate training opportunities. Chiero's (1997) research confirmed that lack of adequate training is a resource frequently mentioned as a major barrier to computer use. Lack of training was the second most often reported barrier in the study done by Franklin (1999). The need for professional development continues to be a concern for public schools.

The Adoption Process

The adoption of technology with instruction presents a challenge to those involved in the change business. Fullan (1999) describes the process of change as being complex, dynamic, and unpredictable. Senge (1990) defines the building process as the capacity to hold a shared common picture of the future we try to build or seek to create. A successful change agent must be comfortable dealing with ambiguities and with failure while remaining focused on the goal.

"Situated" Change: Failure often occurs because reform is often packaged as a "one size fits all" deal. Miller (1996) defines a situated notion of school reform as a reform that "conceptualizes restructuring of pedagogies, curricula, and school organizations as changing in purpose and form across differing educational settings and circumstances" (Miller, 1996). She stresses that the difficulties and divisiveness that often arise occur because reform efforts are generalized to all settings, rather than situated to specific setting.

In order to allow change to be situated, the process of adoption should first begin with the knowledge stage, as Rogers (1995) calls the initial stage of the adoption process. Crucial information needs to be communicated by the change agent to the educational system. Specifically, those in this field need to be aware that the use of technology in education is more than just a technological system or a tool. Instructional technology allows for its innovative capabilities to interact with the creative talents of its participants (Chute, Thompson & Starin, 1996). This information must be successfully disseminated to the users by the change agent if the goal of integration can occur. The challenge of integrating technology into schools and classrooms is really much more human than it is technological (U.S. Office of Technology Assessment, 1995).

Educators must clearly understand that technology changes the context in which education takes place (Lane & Cassidy, 1997). Teacher roles, student roles, school structures, and related issues all need to be defined prior to implementation. However, in order for any school reform to be successful, a goal is necessary, and because of the nature of the school, that goal needs to be directly related to observable student performance. It is important to remember, however, that while the objective of change is the same, the process will be different for each situation.

Developing a Vision: The next step toward adopting educational technology is developing a vision of how technology should influence what educators do (Costello, 1999). The educational staff must contribute to the vision. A team approach creates ownership, which in turn will promote future implementation of the plan. Ownership of the process of change is a powerful motivational strategy.

The key to effective adoption is continued dialogue throughout the process and as newer technologies become available. The premise that we are lifelong learners is a fundamental principle of distance education. Educators need to realistically evaluate the educational system with this in mind. While creating the vision is the second step, the way in which to continually promote change and growth is by maintaining and allowing for modification of the vision.

Wellburn (1996) states that schools which spend time creating an instructional vision based on instructional goals and a shared philosophy have been most successful in adopting educational technology. His findings illustrate Rogers (1995) authoritative type of Innovation-Decisions. First, Wellburn (1996) supports the fact that those in authority need to make the decision to adopt the innovation. Once the decision has been made, those whom it affects are then given the authority to determine how best to implement.

Staff Development: In order for the educational system to survive, it must maintain a competitive edge (Senge, 1990). Historically as well as presently, our schools have been slow in their ability to learn and to adjust to change. The evidence is seen in the rapid acceleration of the computer industry and the relatively slow rate of adoption of its technologies into the classroom.

Teachers need training and they need to be involved in the integration process. When adults see themselves as the locus of causality for their learning, they are much more likely to be intrinsically and positively motivated to change (Wlodkowski, 1993).

According to McKenzie (1998) and the U.S. Office of Technology Assessment (1995), technology training is most effective if presented to teachers in a "just in time" fashion. Teachers will learn as they need to know. Moreover, Gilmore (1995) stresses that staff development should take place in the school. An advantage to this arrangement is that learning occurs in the natural environment. Teachers will be trained with the actual hardware and software that they are expected to use.

In addition, learning along with one's peers creates a cooperative atmosphere. This promotes more exchange of information, more helping and sharing of resources among members, more peer influence toward productivity, higher incidence of creative and risk-taking thinking, higher emotional involvement in and commitment to productivity by more members, higher acceptance and support among members, more of a problem-solving orientation to conflict management, and a lower fear of failure by members (Wlodkowski, 1993). Change will occur most quickly in environments where innovation and collegial sharing are operating simultaneously, each promoting the other (Sandholtz, Kingstaff & Dwyer, 1997).

Certain factors are needed to promote the change. Specifically, due to the perceived complexity of the any technology, an agent should identify needs and provide for leadership and support for the innovation with the teachers expected to adopt (Hutton, 1994). The change agent should also encourage partnerships to develop which would foster the adoption. This process involves identifying the categories of adopters, which in this case would be identifying those with varying degrees of computer experience.

Technical Needs: McKenzie (1998) emphatically states that relying on only a few technology specialists and risking the development of dependency relationships might actually delay the progress toward technology integration. In order to utilize technology effectively, teachers need immediate assistance when equipment fails. Unresolved hardware and software problems will create frustration, and if not dealt with immediately, teachers will abandon the attempt to use the technology.

If, in fact, effective technology use does enhance student learning, then rapid and appropriate incorporation of technology is essential. In a 1995 report, the U.S. Office of Technology Assessment (OTA) asserts that helping teachers use technology effectively may be the most important step to assuring that current and future investments in technology are realized. Sheingold believes that properly trained teachers make the difference between the success or failure of an integration effort (as cited in Roblyer, Edwards, & Havriluk, 1997).

Summary

The appropriate use of technology in education is one viable solution to the challenge of training students for this Age of Information. Relatively few schools offer such a program at present. Research, although still sparse, has indicated that student achievement is comparable to traditional student achievement.

Benefits and barriers have been presented. The most logical benefits are improved student performance, behavior and an efficient manner of procuring information. An additional benefit which needs to be mentioned is the global awareness and education it easily provides for learners.

In addition to barriers referred to previously, logistics present major difficulties. Administrators and staff would need to thoroughly and elaborately organize and prepare for the implementation of technology in the classroom. Many hours would need to be dedicated to studying proper implement procedures. Hardware and software would need to be bought and installed. Space is a consideration. An ongoing needs assessment would be necessary once a program is in place. Technical support throughout would be critical to its survival.

In spite of these potential limitations, educational technology can work effectively with our school systems to properly equip our students for the future. The educational system has to be willing to change and adapt in order to not only survive, but to empower its learners to be proactive participants in this rapidly shifting world.

Experts in the use of instructional technology have suggested that there are four factors necessary to facilitate the adoption of technology. First, the process of change needs to be situated to each particular school. Second, establishing a goal is critical. Third is the necessity of staff development. Finally, technical support must be provided.

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